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(74) Agents: BEIJING LEADER PATENT AGENCY CO.,LTD et al.; Daolong Building, No.13 Huayuanlu, Haidian District, Beijing 100088 (CN).

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(71) Applicant (*for all designated States except US*): BOE TECHNOLOGY GROUP CO.,LTD [CN/CN]; No.10 Jiuxianqiao Road, Chaoyang District, Beijing 100016 (CN).

(72) Inventors; and

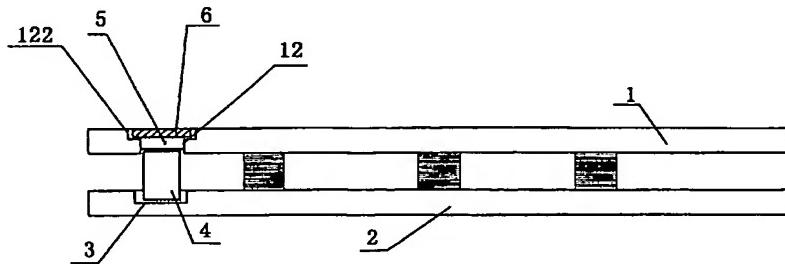
(75) Inventors/Applicants (*for US only*): WU, Jusheng [CN/CN]; No.10 Jiuxianqiao Road, Chaoyang District, Beijing 100016 (CN). LI, Hongyan [CN/CN]; No.10 Jiuxianqiao Road, Chaoyang District, Beijing 100016 (CN).

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(54) Title: EVACUATED GLASS PANEL HAVING DEGASSING DEVICE



(57) Abstract: An evacuated glass panel having degassing device (4) includes at least tow planar glass sheets (2) in any shape and support means posed between said planar glass sheets (2), edge frame component sealed around periphery of the planar glass sheet (2), and degassing device (4) disposed in the evacuated space of evacuated glass panel; between said degassing device (4) and said groove (3) a low melting point glass powder layer (5) is placed and said low melting point glass powder layer (5) is fixed in said groove (3).

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## EVACUATED GLASS PANEL HAVING DEGASSING DEVICE

### Technical Field

The present invention relates to a kind of evacuated glass panel having degassing device, particularly, an evacuated glass panel having degassing device disposed in evacuated chamber of thinner evacuated glass panel, the present invention concerns  
5 the technical field of glass manufacturing.

### Background of the Art

The evacuated glass panel is a kind of high thermo and sound insulating glass panel made by evacuation of the space between planar glass sheets, periphery of which is  
10 sealed.

The evacuated glass panel has been made great achievements through nearly a hundred years' investigation and development. Both the theoretical study and practical test proved that evacuated glass panel is an ideal thermo and sound insulating material and it can be used on doors and windows of building and  
15 thermo-insulating cabinet, refrigerator or freezing cabinet, in order to achieve higher thermo and sound insulating effect, It is necessary to provide higher degree of evacuation.

In order to increase the degree of evacuation people commonly employs degassing device disposed in space between planar glass sheets.

20 The degassing device is made from powder-particles of alloy containing zirconium (Zr) and aluminum (Al) as main ingredients(84% Zr and 16% Al ), which are pressed on a metal base.

After disposing the degassing device in space between planar glass sheets of  
25 evacuated glass panel, employing the vaporization activated by high frequency, to form a fresh interface, which has a strong adsorption in the residual gas left in evacuated space, thereby increasing the degree of evacuation and resisting capability to radiation of the evacuated glass panel.

However, during the procedure of manufacturing evacuated glass having smaller thickness, the disposing degassing device between planar glass sheets becomes very  
30 difficult.

Because the space between planar glass sheets is very small, and the size of degassing device is always larger than the that between planar glass sheets of evacuated glass panel, such a degassing device can not be placed between.

At present, the method for placement of degassing device in thinner evacuated glass

panel is usually to form a groove on the inner surface of planar glass sheet of evacuated glass panel for placing it.

The evacuated glass panel made by this method has greatly reduce its mechanic strength, this is because that at the time of groove forming, stress around the groove is excessively concentrated, at same time around groove , micro cracks will easily occurred, and when the degassing device is heated to high temperature, the micro cracks may further extend. The micro crack and concentration of stress may lead to fracture of the evacuated glass panel during manufacturing process or in practical use therefore, the concentration of stress and occurrence of micro crack greatly decrease the mechanical strength of evacuated glass panel.

In addition, because the air discharge hole of traditional evacuated glass panel is sealed by a small pump-out tube and soldered in air discharge hole, during sealing air discharge hole through solder glass (a low melting point glass powder), the end of pump-out tube is heated to melt and join tube. Because the hole sealing place is protruded from planar glass sheet, a further technologic treatment is necessary, if a mechanic cap or sealing layer protect is added, the structure of sealing air discharge hole is rather complex, operations will be more necessary; in some cases the solder glass and sealing piece is used to sealing air discharge hole, however, in order to insure absence of air leak in air discharge hole, the solder glass and sealing piece is protruded from planar glass sheet after it is melted. Because the sealing place of air discharge hole is uneven(smooth?) after its sealing, said sealing place is easy to be damaged and easily resulted in air leak during assembling and transporting of evacuated glass panel, thereby losing the thermo and sound-insulating effect of evacuated glass panel.

## 25 Summary of the invention

The main object of the present invention is, regarding to the above problem of disposing degassing device during producing process of evacuated glass panel, to provide an evacuated glass panel having degassing device, which can resolve the problem of difficulty in disposing degassing device on one hand, particularly in disposing evacuated glass panel having smaller thickness, and also effectively avoid or greatly reduce the inner stress and micro cracks at place of degassing device on the other hand, there by increasing the mechanic strength of evacuated glass panel, making it not easy to break in use and increasing the ratio of qualitative of evacuated glass panel during production.

A further object of the present invention is, regarding to above shortages of complexity in manufacturing the pomp-out hole and of its easy air leak, to provide an evacuated glass panel having degassing device, said evacuated glass panel has an

even sealing surface of the air discharge hole, effectively overcoming the problems of traditionally protruding sealing surface easily being damaged and resulted in air leak.

Above objects of this invention are realized through following technical schemes:

- 5 An evacuated glass panel having degassing device, which includes at least two planar glass sheets in any shape, support means disposed therebetween, edge frame components sealed around the periphery of the planar glass sheet, and degassing device disposed in the evacuated space of evacuated glass panel, said degassing device is placed in the groove opened on inner surface of planar glass sheet; between  
10 said degassing device and said groove a low melting point glass powder layer is placed, and said degassing device through said low melting point glass powder layer is fixed and joined in said groove.  
Said groove is opened at the same position on the inner surface of two planar glass sheets; in said groove said low melting point glass powder layer is applied.
- 15 Said degassing device simultaneously inserts into the groove on the inner surface at the same position of two planar glass sheets, and through said low melting point glass powder layer fixed and joined with said groove.  
Said planar glass sheet has a sealing piece inserted on its outer surface for sealing the air discharge hole; around the periphery of said air discharge hole at outer  
20 surface of planar glass sheet a concave portion is opened for inserting the sealing piece; Said sealing piece through the low melting point glass powder layer is used to melt and join with concave portion and close said air discharge hole.  
Said sealing piece has a thickness corresponding to the total thickness of low melting point glass powder layer and equal to the deep ness of said concave portion.
- 25 Said groove is opened on inner surface of another planar glass sheet at the same position as air discharge hole, making the another end of degassing device fixed in groove insert into the inner end of said aid discharge hole.  
Said low melting glass powder layer is formed by sintering low melting point powder.
- 30 In the technical schemes of this invention, the low melting point glass powder is applied in groove where degassing device is fixed, after sintering it becomes a low melting point glass powder layer. This scheme can insure to eliminate the influence of stress concentration and micro crack on the strength of evacuated glass panel by low melting point glass powder layer.
- 35 Because the degassing device is sintered in the groove of planar glass, and because the low melting point glass powder has thermal conductivity far lower than that of glass, the instantaneous heating degassing device will not exert a very large influence, there by decreasing the energy consumption and increasing operation effect, and the ratio of qualitatively finished products.

This is not only one, in the technical scheme of present invention because the groove is simultaneously opened on inner surface of top and bottom planar glass sheets, particularly the air discharge hole can be used for placing degassing device, this makes the deepness of groove rather shallow, the mechanic strength of evacuated glass panel specially evacuated glass panel specially evacuated glass panel specially evacuated glass panel of thin type greatly increased.

Moreover, due to the employing even sealing piece for sealing air discharge hole, the danger of air leak in assembly and use is reduced.

### **Brief Description of the Drawings**

- 10 Fig 1 is a schematic cross sectional view of an embodiment according to this invention;  
Fig 2 is a schematic cross sectional view of another embodiment according to this invention.

### **Preferred embodiments**

- 15 The present invention will be described in more detail by way of embodiment with reference to accompany drawings as follows.

#### **Example 1:**

As shown in Fig 1, on the inner surface of top planar glass sheet 1 and bottom planar glass sheet 2 two grooves 3 are simultaneously opened, in groove 3 the degassing device 3 is placed, there by increasing the degree of evacuation and radiation resistance. The tow simultaneously opened grooves avoid the difficulty due to small space of evacuated chamber. The low melting point glass powder is firstly applied between groove 3 and degassing device, then the degassing device is placed, after sintering the low melting point glass powder is solidified forming a low melting point glass powder layer 5. The formed low melting point glass powder layer 5 fixed the degassing device 4 in groove 3.

After the operation of evacuation of evacuated glass panel vaporization activated by high frequency is performed in order to absorb residual gas and increase degree of evacuation, making this embodiment have thermo and sound insulating effect.

30 Moreover, because the low melting point glass powder has thermal conductivity far lower than that of glass, the instantaneous heating degassing device cannot break up the glass, thereby increasing the ratio of qualitatively finished product.

#### **Example 2:**

As shown in Fig 2, on the surface of top planar glass sheet, a air discharge hole 12 for evacuation is opened, around the periphery of said air discharge hole 12 the outer

surface of glass sheet a concave portion 122 is opened, said concave portion 122 can receive a sealing piece 6; said sealing piece 6 through the low melting point glass powder layer 5 is fixed in said concave portion 122, and close said air discharge hole 12 after evacuation of evacuated glass panel.

5 Said sealing piece has a thickness corresponding to the total thickness of the low melting point glass powder layer 5, and equal to the deepness of the concave portion 122, there by making the place of sealing air discharge hole 12 sufficiently even, thus the problem of air leak can be avoid.

10 On the inner surface of bottom glass sheet 2 a groove 3 is opened for placing the degassing device 4, position of said groove 3 is the same as that of said air discharge hole 12 on glass sheet 1.

15 During placing the degassing device 4 with help of the air discharge hole 12 the upper end of degassing device 3 can insert into said air discharge hole 12, this allows make the deepness of groove 3 rather shallow, the mechanical strength of evacuated glass panel increased, thus suitable for production of evacuated glass panel having small thickness.

At last, it should be noted, that above-mentioned embodiments are employed only for description of the technical schemes of the present invention and should not be limited thereon, although the present invention has been detailedly described, it  
20 should be apparent to those of ordinary skilled in the art that modifications and variations may be made without departing from the spirit and scope of the technical schemes of the present invention, all they should be included within the scope of appended claims.

## Claims

1. An evacuated glass panel having degassing device, which includes at least two planar glass sheets with any shape and support means disposed between planar glass sheets, edge frame component sealed around the periphery of the planar glass sheet, and degassing device disposed in the evacuated space of evacuated glass panel, characterized in that said degassing device is placed in the groove opened on inner surface of planar glass sheet; between said degassing device and said groove a low melting point glass powder layer is placed, and said degassing device through said low melting point glass powder layer is fixed and joined in said groove.
2. The evacuated glass panel having degassing device according to claim 1, wherein said groove is opened on inner surface at the same position of two planar glass sheets; in said groove said low melting point glass powder layer is applied.
3. The evacuated glass panel having degassing device according to claim 2, wherein said degassing device simultaneously inserted in to the groove on the inner surface at the same position of two planar glass sheets, and through said low melting glass powder layer faxed and joined with said groove.
4. The evacuated glass panel having device according to claim 3, wherein said groove is a square, circular or cone-shape groove.
5. The evacuated glass panel having degassing device according to claim 1, wherein on outer surface of planar glass sheet a sealing piece for sealing air discharge hole is inserted; around the periphery of said air discharge hole at surface of glass sheet a concave portion is opened for receiving the sealing piece in concave portion; said sealing piece through the low melting point glass powder layer is melted and joined with said concave portion, and close said air discharge hole.
6. The evacuated glass panel having degassing device according to claim 5, wherein said sealing piece has a thickness corresponding to the total thick ness of low melting point glass powder layer, and equal to the deepness of said concave portion.

7. The evacuated glass panel having degassing device according to claim 2 or, 5, wherein said groove is disposed on the inner surface of another planar glass sheet at the said position as that of air discharge hole, making the another end of degassing device insert into inner end portion of said air discharge hole.
- 5  
8. The evacuated glass panel having degassing device according to claim 1, 2, 5 or 6, wherein said low melting glass powder layer is formed through sintering the low melting point glass powder.

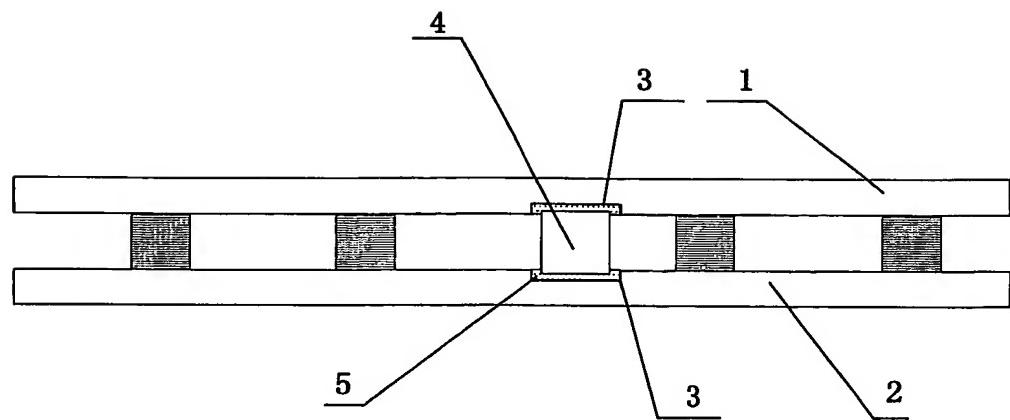


Figure 1

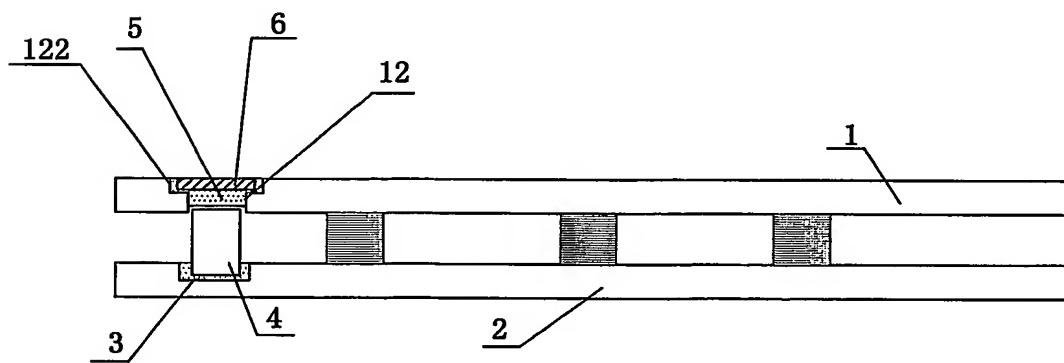


Figure 2

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CN03/00276

## A. CLASSIFICATION OF SUBJECT MATTER

IPC<sup>6</sup>E06B3/67

According to International Patent Classification(IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched(classification system followed by classification symbols)

IPC<sup>6</sup>E06B3/677,3/67,3/66

Documentation searched other than minimum documentation to the extent that such documents are included in the field searched

Chinese patent document(1985~)

Electronic data base consulted during the international search(name of data base and, where practicable, search terms used)

CPRS, WPI, PAJ, EPODOC  
Vacuum, hole, evacuate

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages      | Relevant claim No. |
|-----------|---|--------------------|
| A         | CN2275150Y (JIN Guangheng) 25 Feb.1998(25.02.98)<br>Page3-page4; figures1-2             | 1                  |
| A         | EP0955438A2 10 Nov. 1999(10.11.99)<br>Column3, line11-column4, line14; figures1-6       | 1                  |
| A         | FR2774373A1 (POIX RENE et DELHORME DAVID)<br>06 Aug.1999(06.08.99) abstract; figures1-5 | 1                  |

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

07 Jul. 2003 (07.07.03)

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/CN03/00276**

| Patent document cited in search report | Publication date | Patent family members  | Publication date   |
|--|------------------|--|--|
| CN2275150Y                             | 25.02.98         | None   |  |
| EP0955438A2                            | 10.11.99         | WO9315296<br>AU3444493<br>AU659532<br>JP7508967T<br>US5664395<br>KR253882<br>AT194205T<br>DE69328923D<br>HK1014201<br>CA2127265<br>DE69332844D | 05.08.93<br>01.09.93<br>18.05.95<br>05.10.95<br>09.09.97<br>15.04.00<br>15.07.00<br>03.08.00<br>02.02.01<br>08.10.02<br>08.05.03 |
| FR2774373A1                            | 06.08.99         | None   |  |